

Summary

Suitability of radar and multispectral satellite images from ESA's Sentinel missions to agricultural drought hazard models for selected crops in Poland

The basis for undertaking the research is the possibility of cyclic acquisition of remotely sensed data from Sentinel-1 (S-1) and Sentinel-2 (S-2), which can be used to detail the results generated in the Agricultural Drought Monitoring System (ADMS), conducted by the Institute of Soil Science and Plant Cultivation-State Research Institute (IUNG-PIB) in Puławy.

The adopted research hypothesis assumed that high-resolution temporal and spatial satellite data S-1 and S-2 provide a source of information on agricultural production space, which can be used in the following studies:

- modeling the impact of agricultural drought on crop yields, conducted at the scale of parcels of large-scale farms;
- refinement of soil drought susceptibility maps to a resolution equivalent to the spatial resolution of satellite scenes.

Article A1 shows how farmers' declared losses due to agricultural drought in crops can be verified by using remote sensing data and comparing it with ADMS results. It was shown that in 2021 in the West Pomeranian voivodeship, up to 99% of farmers overestimated the damage to winter wheat crops and declared losses higher than modeled by ADMS (among which 63% of farmers reported losses above the maximum indicated by ADMS (45%) for the region).

Article A2 describes the process of building models (vegetation curves) representing the development of winter wheat, using selected indices calculated from S-1 and S-2 images and ADMS data, on the basis of which it is possible to assess the status and condition of the studied crop.

Article A3 presents the concept of using S-2 satellite imagery to refine the map of soil susceptibility to drought in Poland, based on spatial spectral reflectance from the corn crop under agricultural drought conditions. The best results of the separation of categories of soil susceptibility to drought were obtained for the NDVI index ($p = 0.000012$). In addition; a linear regression curve between estimated total available water content and NDVI values was determined for 30 soil profiles, and a significant relationship between the variables was found ($R^2 = 0.94$).

The results obtained confirmed the established research hypothesis. The developed models have also found practical applications: they are used in public dialogue (IUNG-PIB - MARD - farmers), and in the form of algorithms they supply geomatics tools developed at IUNG-PIB.

Key words: ADMS; Sentinel-1; Sentinel-2; winter wheat; maize;

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